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GLEN C. SANDERSON

GREAT LAKES

REGIONAL RABIES CONFERENCE

SUMMARY REPORT

February 19-20, 1958

Hotel LaSalle
Chicago, Illinois

U. S. Department of Health, Education & Welfare
Public Health Service

Communicable Disease Center
Atlanta 23, Georgia

State of Illinois:
Department of Agriculture
Department of Conservation
Department of Public Health

Illinois State Veterinary Medical Association

GREAT LAKES REGIONAL RABIES CONFERENCE

General Chairman - E. C. Khuen, D.V.M.

Hotel LaSalle
Chicago, Illinois

February 19, 1958

Chairman - Harald M. Graning, M.D., M.P.H.

1. Welcome - Roland R. Cross, M.D., M.P.H.

2. Rabies Control Procedures and Current Status of Rabies in the U. S.
----Ernest S. Tierkel, V.M.D., M.P.H.

3. Rabies in Wildlife ----------Wilford C. Nelson, Jr., B.S.

4. Human Antirabies Prophylaxis

   A. Effect of Local Wound Treatment on the Development of Experimental Rabies ---H. S. Shaughnessy, Ph.D.

   B. Advances in Human Antirabies Vaccination Procedures ----------John Fox, M.D., Ph.D., M.P.H.

   C. Use of Hyperimmune Anti-Serum in Post-Exposure Prophylaxis of Rabies ----------Karl Habel, M.D.

February 20, 1958

Chairmen - A. K. Merriman, D.V.M. and L. R. Davenport, D.V.M.

5. Report from the Illinois Natural History Survey - Sylvatic Rabies Project ---------- Carl Mohr, Ph.D, Rex Lord, Sc. D, & Thomas Barr, MRCVS, M. V. Sc.

6. Reports from the participating States:

   Illinois - by L. R. Davenport, D.V.M. and A. K. Merriman, D.V.M.
   Indiana - by Joseph Salisbury, D.V.M. and A. L. Marshall, Jr., M.D.
   Ohio - by Ralph Masterson, D.V.M. and L. F. Ey
   Michigan - by D. B. Coohon, D.V.M.
   Wisconsin - by H. J. O'Connell, D.V.M.
   Iowa - by S. L. Hendricks, D.V.M.
   Minnesota - by Robert K. Anderson, D.V.M., Ralph West, D.V.M. and C. B. Nelson, M.D.

INTRODUCTION

Experience has shown that the regional approach to the problem of rabies control among the States has proved quite effective. Besides affording the opportunity of presenting new and more efficient measures for the prevention and control of rabies, regional conferences among States with common rabies problems encourages desirable coordination and uniformity of control practices.

The Great Lakes Regional Rabies Conference was held in Chicago, Illinois, on February 19 - 20, 1958 and included participation from rabies control officials in Illinois, Indiana. Michigan, Ohio, Iowa, Wisconsin and Minnesota.

The following report on this conference is a summary of the presentations and is not meant to be a complete record of the proceedings. It is hoped, however, that this condensed version of the presentations and discussions will be of value in rabies control program activities.

Veterinary Public Health Section
Communicable Disease Center
BSS - USPHS
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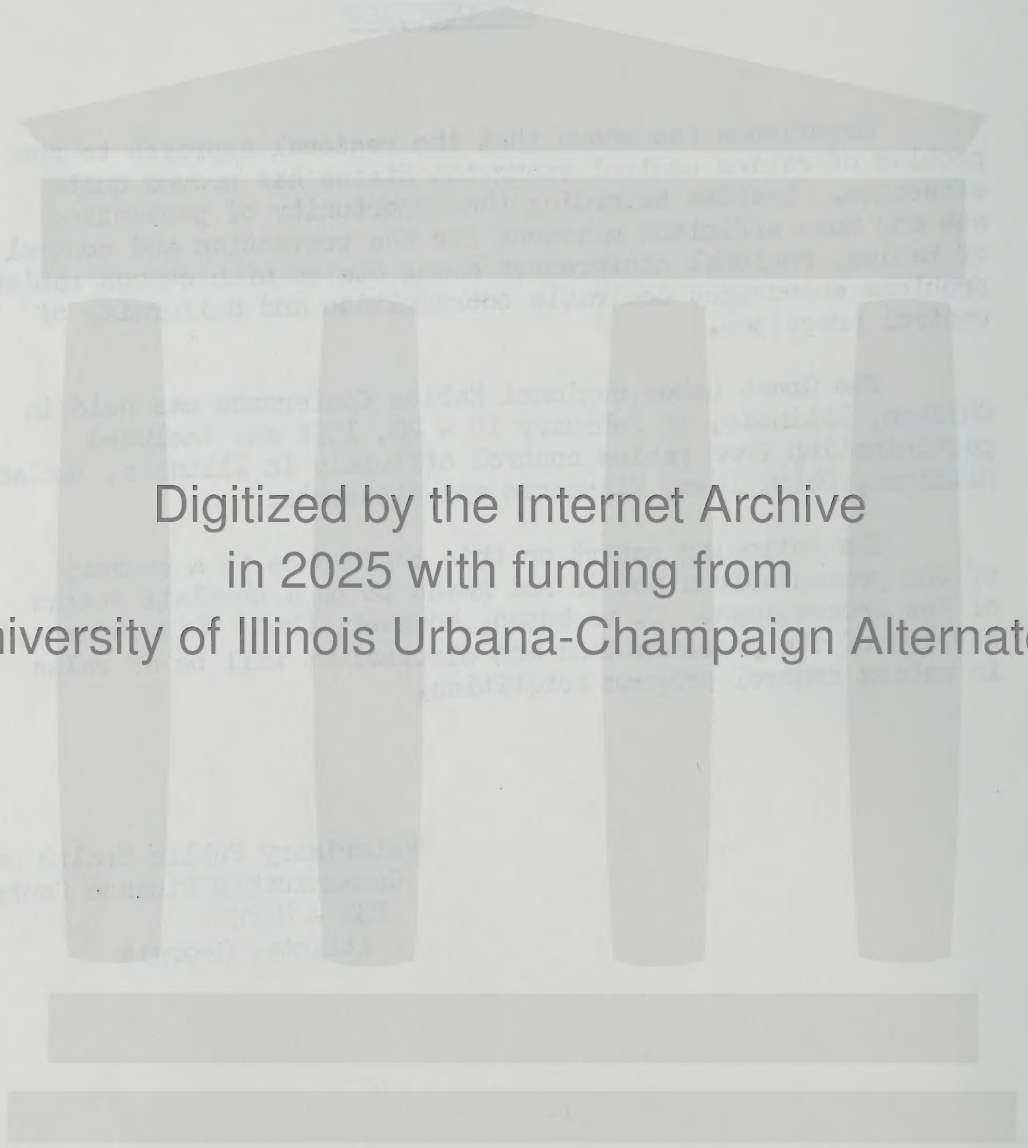

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I. Opening Remarks:

Dr. Harald M. Graning, Chairman of the first session and Dr. Roland R. Cross, Illinois State Director of Public Health greeted the participants and expressed a warm welcome to Chicago, personally and for Governor Stratton. The significance of rabies as a hazard to man and animals in the Great Lakes region was pointed out. The importance of liaison among neighboring states and various agencies for the successful control of rabies was stressed. An outline of surpression of rabies during the past ten years was part of Dr. Cross's address. The decrease in dog rabies incidence in Illinois as well as in the United States was summarized.

II. Scientific Papers.

1. Current Status of Rabies in the United States by Dr. Ernest S. Tierkel.

The reported incidence of animal rabies in the United States during the past year is in the order of 5,000 cases. Over the past twenty years, an average of 23 people yearly have contracted rabies and died. The extend of the public health aspects of the rabies problem is not measured so much by the relatively small number of human deaths in the United States as by the 60,000 human rabies exposures annually, which require the expensive, painful series of 14 to 21 daily vaccinations. This involves a treatment schedule requiring greater professional medical care than most infectious diseases. Since it is common knowledge that there is no cure or recovery once the disease has developed, severe anxiety and fear of rabies occurs in the more than half million people bitten by animals each year. Another point of vital concern is the fact that 52% of the human rabies deaths occur in children under fifteen years of age.

During the past ten years, the total number of reported animal rabies cases in the United States has declined by one-half, with a 68% decrease in the number of dog cases. On the other hand, the number of cases in wild animals has doubled. Foxes and skunks are the principal wild vectors of rabies in the United States. The geographic distribution of fox and skunk rabies is peculiarly discrete, the former restricted to eastern and southern United States and the latter to the great plains of the upper Missouri and Mississippi Valleys and the central valley of California.

It is felt that an important factor in the decline of animal rabies, particularly in dogs, has been improved canine immunization and stray collection programs. About a decade ago, the Communicable Disease Center inaugurated a national rabies control program to coordinate activities of the States in this field. The keystone in suggested organization of Statewide control was the establishment of a sound program within the State health department under the direction of a public health trained veterinarian. The State public health veterinarian coordinates the local control programs throughout the State and guides them in the many technical facets of rabies control. The actual operations of rabies control are carried out at the local level and revolve around a three-point plan as follows: (1) mass intensive immunization of all owned dogs, (2) elimination of strays, (3) reduction of excessive numbers of wildlife vectors.

Since 1948, over 35 States have established these Statewide programs in their health departments. New and more efficient canine antirabies vaccines have been developed and their superior antigenicity proven by laboratory experiments and field trials.

The decline in the incidence of canine rabies (68%) occurred in spite of a rapidly decreasing total dog population during the last decade. There has also been a decrease of over 78% in the incidence of human rabies. Progress has been made in more efficient diagnostic techniques, reporting, preparation of educational materials, and treatment of exposed persons. With increased activity in applied research and improved field control practices, there is every reason to believe that the disease will continue to decline and reach a controllable minimum which will require a level of surveillance activity as part of each State's communicable disease control program.

The trend of rabies in wildlife, on the other hand, is increasing and in future years it is expected that wildlife rabies will become an ever more important aspect of the rabies problem. Foxes and skunks remain the principal wildlife vectors of the disease in the United States. Antibody studies by the Communicable Disease Center suggest evidence of subclinical infection in wildlife vectors in nature. There seems to be a direct relationship of positive titers with history of infection in the areas studied. Large surveys of small wild rodents in high enzootic areas have produced negative results confirming suggestions that these species do not serve as reservoirs or vectors of the disease in nature. Definitive studies in foxes have indicated that this species is not capable of transmitting the disease as a symptomless carrier. The transmitting potential of foxes, however, is a great one as evidenced by the isolation of rabies virus from saliva of infected animals for as long as 17 days.

In 1953 rabies was isolated for the first time from an insectivorous bat in the United States. Since that time isolations have occurred in 18 states among 14 different species of insectivorous bats. These species include colonial or cave-dwelling as well as solitary or tree-living bats. Public health aspects of bat rabies are yet to be delineated clearly. Rabies virus has been isolated from the brains and salivary glands of apparently normal as well as moribund bats. Infection rates as high as 13% have been found in normal bats and as high as 56% in moribund individuals collected in southwestern United States. It is of interest that in 4 out of a sample of 300 and in 12 out of a sample of 203 apparently normal bats virus was isolated from salivary glands and not from the brain. Although it has been possible to infect bats and other species of animals by experimental inoculation of suspensions of bat rabies virus isolates, attempts thus far to produce rabies in susceptible animals by induced bites of rabid bats have been unsuccessful.

2. Rabies in Wildlife by Wilford O. Nelson, Jr., B.S.

Wildlife in the strictest sense of "wild" is a rarity in the United States today. Due to expansion of industrial and residential use of land, wildlife is becoming acclimatized to living near man and is wild only by viture of being unconfined and undomesticated. Two main categories of predator control projects conducted by the U. S. Fish and Wildlife Service were described. One is applied where there are large areas of public lands, such as in the western States, where the Service, through cooperative agreements, assumes both technical and administrative direction. The second is where, by agreement, the Service supplies assistance in carrying out species control programs. Frequent reasons for instituting species control activities is the occurrence of rabid wildlife causing losses in livestock and pets, and necessitating treatment of exposed humans. Little animal control is done on a preventive basis, most of it following critical evidence of rabies in a neighborhood, community, or county. Intensive trapping for the species responsible for the outbreak is the most widely used tool for stemming the epizootic.

Total cases of wildlife rabies in States represented at this conference, Illinois, Indiana, Ohio, Michigan, Wisconsin, Iowa and Minnesota, remained relatively constant over the past few years; however, there has been a significant decrease in fox rabies and an even more drastic increase in skunk, so that the latter is now the most important wildlife vector in this area. For example, Minnesota reported 363 cases of rabies in 1957, 208 of which were in skunks, whereas no case of skunk rabies had been reported prior to 1949 in this State where rabies records go back many years.

The total rabies incidence in Minnesota for the six year period, 1951-1956 is 762, of which 688 were in skunks. During the same period, Wisconsin reported 164 cases, of which 141 were in skunks.

In North Dakota, the Game Department's data suggest that the indigenous rabies virus has some variant characteristics. In their trials, they could not produce furious rabies in foxes or badgers using the local skunk isolates, but transmission from infected foxes to skunks produced furious rabies in the latter. Surprisingly, North Dakota raccoons were very resistant to the local isolates in 1953 but are much more susceptible in 1957.

Some puzzling questions still remain unanswered in wildlife rabies epizootiology; for example, sudden outbreaks in previously rabies-free areas at widely separated points suggest the possibility of unknown reservoirs of the disease, or even some asymptomatic carrier. Another interesting observation is that similarly dense species populations do not always lead to identical outbreaks. For instance, Texas has very high skunk populations, yet skunk rabies is rare, whereas in Minnesota, with a similar population density, skunk rabies is very prevalent. On the other hand, fox rabies is very prevalent in the Eastern part of the U. S., but is rare in North Dakota and surrounding midwestern states, in spite of high fox populations. Bat rabies and its significance in the overall epizootiological picture still remains to be fully explored.

It is hoped that in the future, specific measures to be applied to individual groups of a species will become available for the prevention of rabies outbreaks. For the time being, the empirical approach of the past 40 years appears best; that is, that rapid reduction of numbers in an infected population is preferable to permitting the disease to run its natural course.

3. Human Antirabies Prophylaxis was presented as a three-part panel, covering local treatment, vaccines and hyperimmune serum.

A. Effect of Local Wound Treatment on the Development of Experimental Rabies by Dr. Howard J. Shaughnessy.

Research work conducted on the prevention of rabies by local treatment was described. Using guinea pigs as experimental animals, several agents were compared for their ability to prevent rabies by local application to a virus-contaminated wound. In one series, fuming nitric acid, 20% soap solution and tincture of iodine were used on groups of guinea pigs exposed by introduction of known invasive virus into ragged wounds on the back of the neck. Groups of 20 animals were treated by the various agents $\frac{1}{2}$, 2 and 6 hours after exposure. Twenty controls were used for comparison. Soap solution was used by thorough

irrigation with syringe and blunt needle, nitric acid by glass rod application, iodine by cotton swab. In these experiments, fuming nitric acid and 20% soap irrigation were similarly effective, giving about 90% survival if given 30 minutes after exposure, about 80% survival if treated two hours after exposure and 65% six hours after. Tincture of iodine was inferior to the two other agents; two hours after exposure, it gave only about 65% survival rate. Survival in exposed untreated animals was about 35%.

In a second series, 4% aqueous zephyran, 20% soap, and fuming nitric acid were compared. Soap and zephiran were applied with cotton swabs, fuming nitric acid by glass rod.

When the wound was treated 30 minutes after exposure, zephyran gave about 90% survival, fuming nitric acid about 75%, soap about 55%. Of the controls which were exposed and received no treatment, only 3% survived.

In later experiments, 1% zephyran was about as effective as the 4% solution and was much less injurious to tissues.

The conclusion was that zephyran chloride, a cationic detergent, was apparently more effective than either 20% soap or fuming nitric acid. Thorough irrigation with 20% soap was approximately as effective as fuming nitric acid cautery.

Use of nitric acid resulted in severe burns and scarring; the wounds required about four weeks to heal. Soap and zephyran chloride treated wounds healed in about two weeks with minimal scarring.

Tincture of iodine was considerably less effective than the three mentioned above; methiolate, metaphen and silver nitrate were ineffective.

B. Advances in Human Antirabies Vaccination Procedures by Dr. John P. Fox

Measures intended to prevent rabies in man may be divided into two basic categories: those taken before and those taken after the infecting bite. Historically the first category has embraced measures to avoid being bitten and measures to control animal rabies. The second category comprises local cleansing of the bite wound, specific active immunization following suspected exposure and, recently, administration of antirabies hyperimmune serum.

The development of antirabies vaccines prepared in avian embryos (chicken or duck) merits thorough investigation as to applicability

of these vaccines in the "before bite" and "after bite" preventive measures. These vaccines, essentially free of central nervous system tissue, could not induce neuroparalytic accidents attributed to the demyelinating reaction often resulting from Pasteur treatment with conventional vaccines of nervous tissue origin.

The avian vaccine most extensively studied in man is that made from chick embryos infected with a high egg passage (HEP) Flury strain virus. Over a thousand volunteers have received various schedules with this vaccine without serious undesirable side reactions. Local reactions have constituted the chief but still not very frequent post vaccination complaint. It soon became clear that although live, the HEP Flury virus is not able to multiply in man and acts only as a dead antigen. For that reason repeated inoculations are necessary to produce detectable antibody levels in individuals who had not received antirabies treatment previously. To date the most practical and effective regime using HEP Flury vaccine appears to be the administration of 3-4 intradermal doses about a week apart with a booster 30 to 45 days after the last dose. About 0.2 ml. of a 33% suspension appears to be the amount of choice to inject intradermally. Individuals who had had previous courses of either nervous tissue antirabies vaccine or courses of Flury strain live modified virus vaccine exhibited a very favorable antibody response to a single intradermal booster inoculation of HEP Flury vaccine.

A second antirabies vaccine produced in avian embryos is a killed fixed virus grown on duck embryos. Beta propiolactone is used as the killing agent for the virus. This product is designed to be administered in a manner similar to that in which Semple and Harris type vaccines are used, that is, 14 daily inoculations subcutaneously. This vaccine has performed well enough in mouse protection tests and other potency trials that it is now licensed by the National Institutes of Health and approved for use as a standard antirabies vaccine. In a limited number of human volunteers the duck embryo vaccine did not elicit quite as high an antibody titer response as Semple type vaccines. There is some indication that this product would perform more satisfactorily if it were administered intradermally rather than subcutaneously. Investigations are in progress to evaluate this factor. In cases where definite exposure has occurred and antirabies treatment is necessary, a person who has never received antirabies treatment before may now choose between a course of brain tissue or killed duck embryo vaccine, each consisting of 14 to 21 daily injections. Individuals who had received antirabies vaccine prophylaxis with a known potent vaccine any time previously during their life-time have responded well enough to a single dose of high egg passage chick embryo vaccine that a single booster dose of any potent vaccine may become the recommendation of choice for this group. For severe multiple wounds, especially those around the head, face and neck, two boosters five

days apart may be recommended for individuals who had been previously vaccinated.

Being essentially free of serious side reactions, the avian embryo vaccines may be used in the "before the bite" group of preventive measures. Such persons as veterinarians, dog wardens, mailmen, and others forming a high risk population as regards to dog bite, may find it advantageous to receive the previously described initial course of avian embryo vaccine, that is, three intradermal doses five to seven days apart followed by a booster 30 to 45 days later. A person so treated should be in a position to safely receive one to two further injections of avian embryo vaccine in the case of a rabies exposure. In the absence of rabies exposures it would probably be advisable for these persons to receive a booster about every five years.

The avian embryo vaccines are now under investigation by several research organizations as well as biologics manufacturers. They offer promise of adequate antirabies protection with a minimum risk of undesirable side reactions. It should be noted that procedures other than administration of vaccine remain essentially unchanged in cases of animal bite. Strict confinement and thorough observation of the biting animal, careful and thorough cleansing and washing of the bite wound using large quantities of soap and water, complete history of biting animal regarding vaccination status and the animal's general health remain as important as ever.

C. Use of Hyperimmune Antiserum in Post-Exposure Prophylaxis of Rabies by Karl Habel, M.D.

For a few years a product imparting temporary passive immunity to individuals bitten by rabid animals has been available through regular supply channels. This product is hyperimmune antirabies serum produced in horses who had received multiple doses of either killed or modified rabies antigens. Its administration is recommended for individuals with severe or multiple bite wounds especially around the head, face, and neck. Extensive studies had previously demonstrated that individuals receiving vaccine alone have no detectable rabies antibodies in their serum until at least 10-14 days after the beginning of the vaccine treatment. Therefore, when there is reason to believe that the exposure is such that rabies may develop after a short incubation period, the hyperimmune serum would provide preformed antibodies for immediate protection from the street virus. A dramatic field trial of hyperimmune serum took place in Iran in August, 1954. One rabid wolf invaded a village and bit 29 persons. Eighteen of these had been bitten on the head. Previous statistics show that individuals bitten on the head by Iranian wolves develop rabies in 40% of the cases in spite of vaccine treatment. In this

incident, 13 of the individuals suffering from head wounds received hyperimmune serum in addition to the standard vaccine treatment and five received the standard vaccine treatment only. In the serum-vaccine group one out of 13 patients developed rabies and died. In the vaccine alone group, three out of five head wounds resulted in clinical rabies and death. Of the 11 individuals receiving bites on trunk and extremities, none died; four of them receive serum plus vaccine, the rest vaccine only.

Numerous experiments on laboratory animals and human volunteers have been conducted to determine optimum utilization of hyperimmune antirabies serum. It soon became evident that serum cannot replace, but must be used in combination with, a potent antirabies vaccine. It was also shown that repeated doses of hyperimmune serum depress vaccine response, so a single standard dose of serum only should be given, followed by a full course of 14 to 21 daily vaccine injections. The World Health Organization specifies that therapeutic serum should contain a minimum of 80 international units per ml. The dosage recommended is a quarter ml. or approximately 20 international units per pound of body weight. This is to be injected intramuscularly in one or several sites at the same time. Protection tests in animals indicate that antirabies serum is effective as a local prophylactic agent when small amounts are injected at the site of injury. Therefore, where the site permits, a portion of the above dose should be infiltrated around and under bite wounds. When used in this manner, prophylactic treatment including administration of serum and vaccine results in satisfactory antibody levels from the first day of treatment followed by a sustained rise in the antibody titer throughout the duration of vaccine administration and a persistence of high level antibody titer through at least the 28th day at which time most of the volunteer experiments were discontinued. Since serum-sickness is a comparatively common side reaction to the administration of horse serum, this product is recommended only for severe rabies exposures. Prior to administration a complete medical history of the prospective recipient should be taken with particular attention to previous reactions following the use of biologics. An intradermal or ophthalmic sensitivity test using diluted horse serum should be performed prior to administering the full dose of hyperimmune antirabies horse serum. Research is in progress which may result in a more effective and less hazardous biologic for the production of immediate passive immunity to rabies.

5. Report from the Illinois Natural History Survey - Sylvatic Rabies Project by Dr, Carl Mohr, Dr. Rex Lord & Dr. Thomas Barr.

The objective of the above project is to determine the relationship of rabies enzootics and epizootics to the distribution, abundance, and intermingling of various wildlife species. Although the principal vector

of rabies for cattle, humans, and dogs is well known in many areas, the sustaining reservoir might be a different species. Investigations are at present being conducted in northwestern Illinois where the skunk is the most frequently reported vector of rabies.

An interesting field observation has been that considerable numbers of red and hoary bats (Lasiurus borealis and Lasiurus cinereus) go into caves to die although these species are usually solitary and roost in trees. This observation may have an important influence in the understanding of the relationship between colonial and solitary bats and on disease transmission among them. Of the several dozen sick or nearly dead bats tested for presence of rabies virus none have been positive to date.

Laboratory investigations in the susceptibility of opposums to rabies virus seem to indicate that this species is comparatively resistant to it. Of 45 opossums inoculated (40 intramuscularly, 5 intracerebrally) none died. Experiments are still in progress to compare in detail the relative susceptibility of opossums with that of mice and other experimental mammals.

Carnivore populations in general are now at an unusually high level and some species have extended their range in North America. Future trends are difficult to predict because fast changing agricultural patterns have obscured natural trends in populations. The phenomenon of two seasonal peaks in sylvatic rabies reported from several areas probably can be explained on the basis of available knowledge in wildlife dynamics. The well known "fall shuffle" results from the breakup of wild carnivore family groups. In autumn the young disperse looking for their own home ranges while the adults maintain the old. Chances of contact among individuals are vastly increased by the intensive movement. The disease transmission potential is also enhanced and if a reasonable time lapse is allowed for the average incubation period of rabies and the interval necessary for the buildup of infected animals, the "fall shuffle" may well account for the mid-winter sylvatic rabies peak. The second peak report in late spring or early summer may be explained similarly by increased contact prior to and during the mating season. On the basis of relative density of autumn and spring carnivore populations, the mid-winter peak in rabies would be expected to nearly double the late spring peak.

6. Reports from the Participating States & Panel Discussions.

Illinois Report by Dr. L. R. Davenport & Dr. A. K. Merriman.

Over the past five years animal rabies incidence in Illinois has shown a definite decrease. For example, positive cases in 1953 were 236, whereas in 1957 there were only 90. The difference is almost entirely

due to a spectacular decrease in the number of cases among dogs. It is felt that an important reason for the decreasing rabies incidence in Illinois has been the application of intensive control measures and educational activities administered by the State Departments of Agriculture and Health. These activities were assisted by a new rabies control law passed in 1953, resulting in better local programs and extensive vaccination of dogs. From 1954 to 1957 an average of over 250,000 dogs were vaccinated yearly. Comparative incidence for various species in 1953 and 1957 is below:

TOTAL POSITIVE RABIES CASES (Illinois)

	1953	1957
Dogs	174	21
Cats	19	12
Cattle	20	14
Swine	0	1
Foxes	12	2
Skunks	4	31
Raccoons	2	2
Opossums	0	1
Squirrels	3	4
Rats	0	1
Muskrats	0	1
Horses	1	0
Rabbits	1	0
	236	90

In 1953, 20 rabies quarantines were issued during the year. In 1957 for the first time in over eight years no rabies quarantines were issued.

The number of antirabies prophylactic treatments administered yearly has also decreased from a high of 3,088 in 1954 to a low of 1,168

in 1957. The number of human bites inflicted by animals, on the other hand, has remained fairly constant over the past five years totaling about 17,000 yearly in Illinois. Statistics dealing with reported human exposures and treatments follow:

Five Year Period 1953-1957* (Illinois)

Year	Dog & Other Animal Bites	No. of Pasteur Treatments	Human Rabies Reported	No. of Post-Vaccinal Accidents Reported
1953	15,103	2,168	0	0
1954	20,817	3,088	1	1
1955	17,041	1,813	0	3
1956	18,981	1,422	0	2
1957	17,105	1,168	0	0
	89,047	9,659	1	6

*Data for 1957 provisional.

It is interesting to note that the post-vaccinal accidents reported over the five-year period, 1953-1957 occurred slightly less frequently than once for every 1,600 Pasteur treatments given.

The Illinois rabies control act requires prompt reporting of all animal bites, strict confinement of biting animals for a 10-day observation period and submission to a recognized laboratory of the heads of all animals dying during the observation period or suspected of having rabies.

Contrary to the general trend, skunk rabies has been showing a definite increase during the past five years. In 1953, four skunks accounted for less than 2% of the 236 total rabies, in 1957, 31 skunks constituted over 1/3 of the State rabies total. The reasons for this trend are at present being investigated by the Illinois State Natural History Survey and the University of Illinois College of Veterinary Medicine.

Michigan Report by Dr. D. B. Coohon

Rabies appears well controlled at present in the Michigan dog population. Rabies incidence has decreased from a high of 715 animals in 1940 to only 28 rabid animals in 1957. Canine rabies incidence for the above two years was 598 in 1940 and 10 in 1957. A compulsory vaccination requirement is in effect in seven Michigan counties. In addition, nearly all townships and cities in Wayne county including

Detroit have local vaccination requirements in effect. Skunk rabies has been on the increase over the past few years. This species is being closely watched.

There is considerable interchange of wildlife between Canada and the upper peninsula of Michigan by way of the frozen St. Marys River during the winter. In an effort to provide a buffer zone with immune dog population, intensive dog vaccination programs have been instituted in February and March, 1957, using chick embryo modified live vaccine. A total of 1,600 dogs were vaccinated in Chippewa County which lies along the St. Marys River. This is estimated to be 80% of the dog population in Chippewa County. Canadian authorities had similarily vaccinated dogs and cats along the St. Marys River in Ontario in 1956. Control of rabies has been achieved by cooperation of local and state government officials, members of the veterinary medical and medical professions, and the citizens of Michigan. A special tribute should be given the local health officials, practicing physicians, and veterinarians in our seven compulsory vaccination counties, and the city of Detroit.

Incidence of Rabies in Michigan

1953-1957

Year	Dog	Cattle	Horse	Sheep	Swine	Cat	Skunk	Misc.	Man	Total
1953	127	9	1	1	2	10	3	Raccoon-1	0	154
1954	96	6	1	0	0	9	5	0	0	117
1955	26	5	1	0	0	3	2	0	0	37
1956	9	2	0	0	0	4	6	Raccoon-1 Bat -1	0	23
1957	10	3	1	0	0	3	10	Bat -1	0	28

Animal Bites & Human Antirabies Vaccine Distributed

Year	Bites Reported	Doses Human Vaccine Distb.
1953	10,689	29,246
1954	13,152	30,709
1955	14,457	28,462
1956	15,919	25,322
1957	16,610	24,369

Iowa Report by Dr. Stanley L. Hendricks

Official records indicate rabies occurred in animals in Iowa prior to 1890. Clinical cases of the disease were reported from Lucas County in 1888 (3 horses, 5 hogs, 6 cattle, 6 dogs). Laboratory examination of suspected heads has been done since 1905 and records show the disease has existed enzootically in the state since that time. The first reported case in wildlife was a skunk in 1916.

Rabies is widely scattered throughout the State with cases reported from about three-fourths of the counties each year.

A seasonal trend is noted with an increased incidence during the late spring months. This trend is most noticeable among skunks and cattle.

Since 1952, almost one-half of the reported cases of rabies have been in skunks and about one-fourth in cattle. Cases are reported in several other species.

Of the total of 3,137 positive heads of all species for the ten-year period 1946 to 1955, 164 or 17.6% were Negri negative. The percentage of positive heads that were Negri negative varied widely among the different species. For example, only 2.8% of the positive skunk heads were Negri negative, whereas 37% of the positive cattle heads were Negri negative.

No human rabies has been reported in Iowa since 1951.

The 1957 Iowa animal rabies incidence is reproduced below. The general trend has continued, the skunk remaining the most frequently rabid animal and accounting for over half of the total rabies cases.

Rabies in Animals in Iowa in 1957

Species	Cases
Skunk	128
Cattle	66
Cat	18
Dog	16
Raccoon	7
Fox	6
Hog	2
Horse	2
Squirrel	2
Total	247

Indiana Report by Dr. Joseph Salisbury and Dr. A. L. Marshall, Jr.

Rabies has been steadily declining in Indiana for the past few years as shown on the annual incidence chart below:

Rabies in Animals in Indiana

1953 - 1957

Year	Dogs	Cats	Cattle	Foxes	Skunks	Others	Humans	Total
1953	372	24	13	13	5	3	0	430
1954	308	30	17	8	4	4	0	371
1955	123	6	6	2	2	0	0	139
1956	199	8	11	3	3	5	1	230
1957	94	6	8	7	2	1	0	118

The number of heads examined for rabies have remained fairly constant over the same period of years being 1,328 in 1953 and 1,507 in 1957. Of the specimens received for examination 32.3 were determined positive in 1953 whereas only 7.8% were positive in 1957. For the past few years human bites inflicted by animals have been reportable to the State Dept. of Health. In 1957, a total of 3,799 animal bites were reported under this program; 3,474 of these were inflicted by dogs, 197 by cats, 25 by rats, the remainder by a variety of animals. Thirty-four persons are known to have received Pasteur treatment in Indiana in 1957, 32 were bitten by dogs, 1 by a cat, and 1 by animal species unknown. It has not been ascertained how many of the remaining 3,765 persons bitten by animals received vaccine antirabies prophylaxis.

Wisconsin Report by Dr. H. J. O'Connel

Skunk rabies has been quite prevalent in Wisconsin since 1952. Of all positive specimens since that year, skunks accounted for 45.5%, dogs 20.5%, cattle 14.6%, Foxes 5.5%, cats 5% and other animals 8.9%. The total number of rabies diagnoses from 1952-1957 is 343: 190 cases in wildlife, 152 in domestic animals and 1 in a human. The history of exposure is known in over 50% of the domestic animal cases. It is interesting to note that in all but two, the exposure was due to rabid skunks. Rabies incidence in Wisconsin has been exhibiting noticeable upturns during two periods of the year, one in December and January and the other around April through July. Infection appears evenly spread over Wisconsin except for the northern timber and resort area. Generally

the same areas are affected by both wildlife and domestic animal rabies. Good farm lands are apparently most frequently affected with rabies in both wild and domestic animals. When the seasonal incidence of rabies in wildlife and domestic animals is plotted separately, the increase in wildlife occurs about one month preceding the increase of rabies in domestic animals. The annual incidence in both shows parallel fluctuations.

Ohio Report by Dr. Ralph Masterson and Mr. L. F. Ey

In Ohio, rabies control is not vested in any one agency but is implied as a responsibility of the State Department of Health. As part of its activities under this responsibility the Ohio Health Department has been carrying on dog warden conferences for the past two years. The conferences are given in various parts of the State and are designed chiefly to enlighten dog wardens about rabies. The wardens are informed of the role that they can play in the control of this disease through education of the public, proper conduct of a dog pound, enforcement of dog laws and other activities. By law, dog wardens are employed and paid by the county commissioners of the various counties and are, therefore, not under jurisdiction of the local health departments. Through these conferences, however, they are made familiar with public health attitudes and are made to feel part of the health team.

Ohio's rabies incidence for the past five years is reproduced below:

Summary of Ohio's Rabies Report

1953		1954		1955		1956		1957	
Cat	4	Cat	17	Cat	4	Bat	2	Cat	17
Cow	26	Cow	43	Cow	27	Cat	11	Cow	31
Dog	109	Dog	143	Dog	141	Cow	20	Dog	153
Fox	17	Fox	38	Fox	40	Dog	214	Fox	41
Horse	2	Horse	4	Horse	2	Fox	23	Horse	1
Skunk	12	Sheep	3	Human	1	Horse	2	Pig	1
Swine	1	Skunk	12	Sheep	13	Skunk	28	Raccoon	3
				Skunk	15			Sheep	6
								Skunk	35
Totals	171		260		243		300		288

It is interesting to note that prior to 1953 the skunk was infrequently involved in rabies reports. Since that time, however, cases of skunk rabies have been on the increase so that at the present time Ohio is about equally affected with fox and skunk rabies.

Since 1898, when the laboratory of the Ohio Department of Health was originally opened, to date, over 37,000 animal heads have been examined. Of this number 10,231 were reported positive for rabies. The preponderance of cases in the past two years orignated from six counties in the southern part of the state. In 1956, of 241 positive animal heads, 149 were from 5 southern counties. In 1957, of 252 positives, 173 were from six southern counties. The first human rabies death of 1958 occurred on February 1, in one of these counties. It was in a four-year-old girl who was severely bitten on the forehead by a stray dog, December 24, 1957.

Ohio vital statistics reveal that since 1907, 179 humans died of rabies. The case preceding the child who had died this February occurred in 1955 in an adult male who had picked up an ill skunk and was bitten by the animal. Death occurred about seven weeks after exposure.

Minnesota Report by Dr. R. Anderson, Dr. R. West, & Dr. C. Nelson representing the Minnesota State Board of Health, the Minnesota Livestock Sanitary Board, The University of Minnesota, College of Veterinary Medicine and the Minnesota State Dept. of Conservation.

Total reported cases of animal rabies in Minnesota reached a new high in the history of the State with 366 cases reported in 1957. Although 29 cases of canine rabies were reported in 1957, the greatest number of cases, 237, were reported in wildlife. Therefore, it can be seen that sylvatic rabies is the principal problem in Minnesota at present. The skunk can be described as the major rabies vector in the State, since of the 237 reported cases of rabies in wild animals, 217 were reported in skunks and civet cats (spotted skunks).

Rabies has been reported in many species of animals in the State, including bats, badgers, cats, cattle, civet cats, coyote, dog, fox, goat, gopher, groundhog, horse, mink, mouse, muskrat, rabbit, raccoon, rat, sheep, skunk, squirrel, swine, weasel and woodchuck. Bat rabies was first reported in the State in the fall of 1956.

Minnesota's last case of human rabies occurred in 1917; however, several hundred people receive prophylaxis each year, as a result of being bitten by known or suspected rabid animals.

In 1945 and 1946, there were no reported cases of animal rabies in Minnesota. In 1947, one case of animal rabies was reported in a southeastern county. In 1948, there were five cases reported from several of the southeastern counties and thereafter the disease spread

slowly northward and westward with the number of reported cases increasing each year, except for temporary regressions in 1953 and 1955. At the present time, all counties in Minnesota, except the seven northeastern counties, have reported cases of animal rabies.

The level of canine rabies vaccination in the State is low; Minnesota has a large proportion of susceptible dogs. Cases of dog rabies occurring in 1956-57 were reviewed recently and all those where the source of exposure could be traced were attributable to wild animals, primarily skunks. No canine case was reported resulting from exposure to another rabid dog.

Canine rabies control in Minnesota is based on quarantine of animals, townships and municipalities. Whenever a canine case occurs, all other exposed animals are quarantined for six months or immediately disposed of. If the rabid dog was a stray or had been at large, all dogs within the township are required to be adequately confined, muzzled or leashed.

It is interesting to note that, throughout the past several years, skunk rabies has accounted for 50-60% of the reported cases of rabies in the State. As a result the losses from bovine rabies, as would be expected, have been rather large and cattle were the second species in number (70) of reported cases of rabies last year.

It would appear that measures to lower or decrease the skunk population in Minnesota may perhaps provide some control of rabies by decreasing the number of primary vectors of the disease. Many questions have been raised, however, as to the most feasible method which might be used to decrease the skunk population, as well as additional questions regarding the effect of such a decrease on the wildlife balance in the State.

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